

Section 7 - Image Subsystem

The Image Subsystem processes video from the CCD Camera to produce enhanced images for the Display Subsystem monitors and Cine Disk Subsystem. The Image Subsystem also produces standard resolution interlaced video for the optional VCR. It also produces digitized images for the DICOM interface, optional laser camera, and optional hardcopy devices. The Image Subsystem includes the Video Controller PCB, Image Processor PCB, and Display Adapter PCB, all of which are located in the Workstation's Electronics Box.

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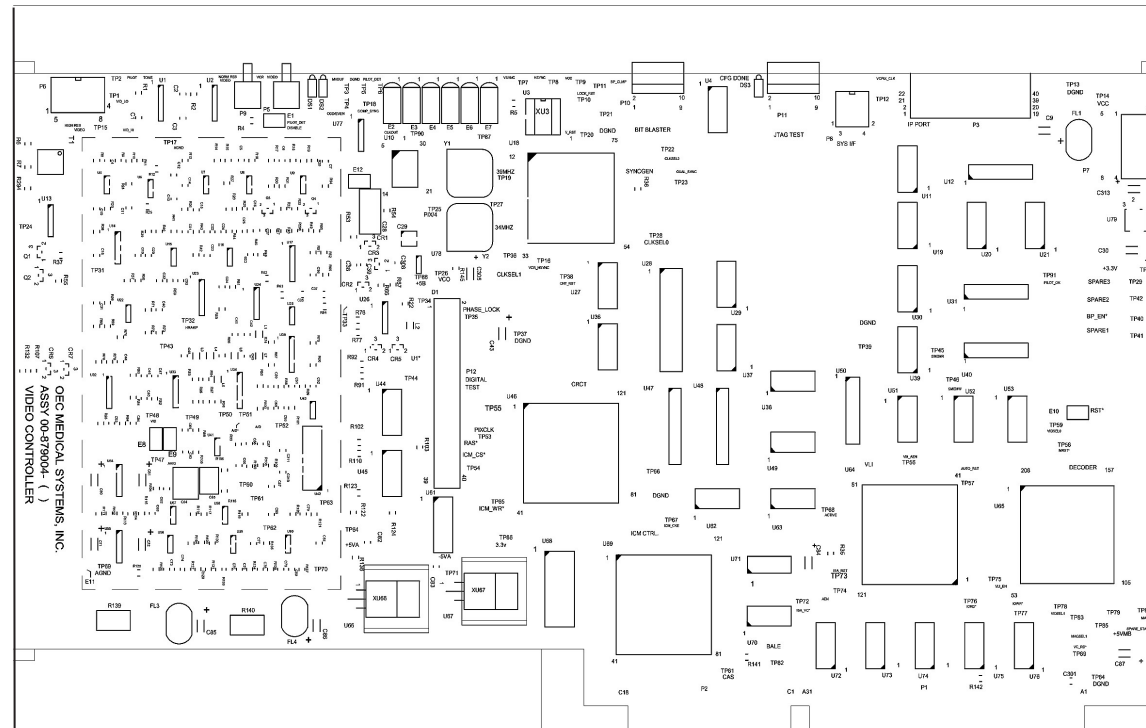
Video Controller PCB

The Video Controller PCB accepts analog differential video and pilot tone (sync) signals from the CCD camera. The pilot tone signal contains sync, drive, and pixel clock data. The Video Controller converts the analog video signal to parallel digital data, and sends it to the Image Processor PCB.

The Video Controller performs Genlock control for the Workstation, anti-aliasing and anti-vignetting of the digital X-Ray images, and creates the VLI window needed for the X-Ray Generator to perform Automatic Brightness Stabilization.

Location

The Video Controller PCB mounts in ISA slot 1 on the Host Pentium motherboard or the Passive Backplane. The following assembly drawing shows the major components on the board.



Video Controller PCB

Circuit Description

Please refer to **Video Controller Schematic 00-879002** while reading the following information.

The Video Controller is a complex PCB with many surface mount components. While repair of this board in the field is not practical, it is important to understand its basic functions so you can replace it when it is faulty.

CCD Video Path

Differential analog video from the CCD camera enters the Workstation over the Lemo cable, and enters the Video Controller on P6. From there, CCD video travels through op amp U5 to mux U14. ISA bus address decoder U65 selects the video through video separator U22 and into voltage-controlled gain amplifier U32, which combines the video with horizontal and vertical sync signals that have been anti-vignette processed by U23, U54, U55, U57 and U60. The composite video signal out of U33 is scaled by a mag select signal from ISA bus decoder, and then passes through a 25 MHz anti-alias, low-pass filter to a differential amplifier consisting of U51 and U56. Analog to digital conversion of the high resolution video takes place in U42, which passes the digital video signal through pixel interpolator U46 before passing it on to the Image Processor.

Sync Stripper U17 produces a composite sync signal from the high resolution video signal. Sync generator U18 produces the back porch clamp, horizontal sync, and vertical sync from this composite sync signal. The sync generator also produces a video select signal that turns on the 25 MHz anti-alias LP filter.

Pilot Tone Path

The Pilot Tone (synchronization) signal from the CCD camera enters the Workstation over the Lemo cable, and enters the Video Controller PCB on P6. The Pilot Tone signal travels through transformer T1 to differential amplifier U1, and then triggers flip flop U2, producing a PILOT_DET signal. The PILOT_DET signal triggers sync generator U18, which then generates the pixel clock, horizontal sync, vertical sync, and field index signals. The Video Controller PCB passes these signals on to the Image Processor PCB.

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VCR Video Path

Composite video from the VCR enters the Workstation through BNC connector J6, and enters the Video Controller on J5. From there, the video travels through op amp U8 to mux U14. ISA bus address decoder U65 selects the video through video separator U22 bypassing voltage-controlled gain amplifier U32. The composite video signal out of U33 passes through a 5 MHz anti-alias, low-pass filter to a differential amplifier consisting of U41 and U56. Analog to digital conversion of the VCR video takes place in U42, which passes the digital video signal through pixel interpolator U46 before passing it on to the Image Processor.

Sync Stripper U6 produces a composite sync signal from the VCR's video signal. Sync generator U18 produces the back porch clamp, horizontal sync, and vertical sync from this composite sync signal. The sync generator also produces a video select signal that turns on the 5 MHz anti-alias LP filter.

Test Points

Although there are several test points along the front edge of the Video Controller PCB, none are really useful in troubleshooting the board. There is no extender for the card, so test points not along the front edge of the card are not accessible.

Circuit Breakers and Fuses

There are no circuit breakers or fuses on the Video Controller PCB.

Troubleshooting

Symptoms that indicate possible Video Controller PCB failure include:

- Unstable image - sync detector/generator failure
- Video noise - A/D failure
- Pixel blemishes - failure to correct for pixel gain and/or offset. Interpolation errors. Decoder failure.
- Rolling or torn image - Decoder failure
- Wrong video source - Decoder failure
- No image display - PIXCLK generation failure
- Incorrect patient dose - VLI failure

The Video Controller PCB has three LEDs that can provide limited troubleshooting help.

Removal and Replacement

Follow these steps to replace the Video Controller PCB:

1. Turn off the Workstation and unplug it from the AC outlet.
2. Remove the Workstation Front Cover.
3. Open the Electronics box and locate the **Video Controller PCB**.
4. Remove the two screws that secure the PCB to the Electronics box.
5. Carefully remove all cables connected to the front edge of the PCB. If necessary, tag connectors for easier identification later.
6. Withdraw PCB from Electronics box and place in antistatic bag
7. Connect cables you removed in step 5 to replacement Video Controller PCB.
8. Install replacement Video Controller PCB in Electronics box.
9. Install screws you removed in step 4.
10. Connect Workstation to AC outlet and test it for proper operation.
11. Close Electronics box.
12. Install Workstation Front Cover.

Image Processor PCB

As its name implies, the Image Processor PCB manipulates the digital video from the Video Controller PCB to produce the following effects and functions in the displayed image:

- Vertical and horizontal image reversal.
- Circular blanking
- Window and level control
- Automatic sample window positioning
- Real-time image edge enhancement
- Subtraction
- Peak opacification
- Zoom and roam
- Cine interface generation
- Text and graphics for image annotation.

Location

The Image Processor PCB mounts in PCI slot 6 on the Host Pentium motherboard or the Passive Backplane. The following assembly drawing shows the major components on the board.

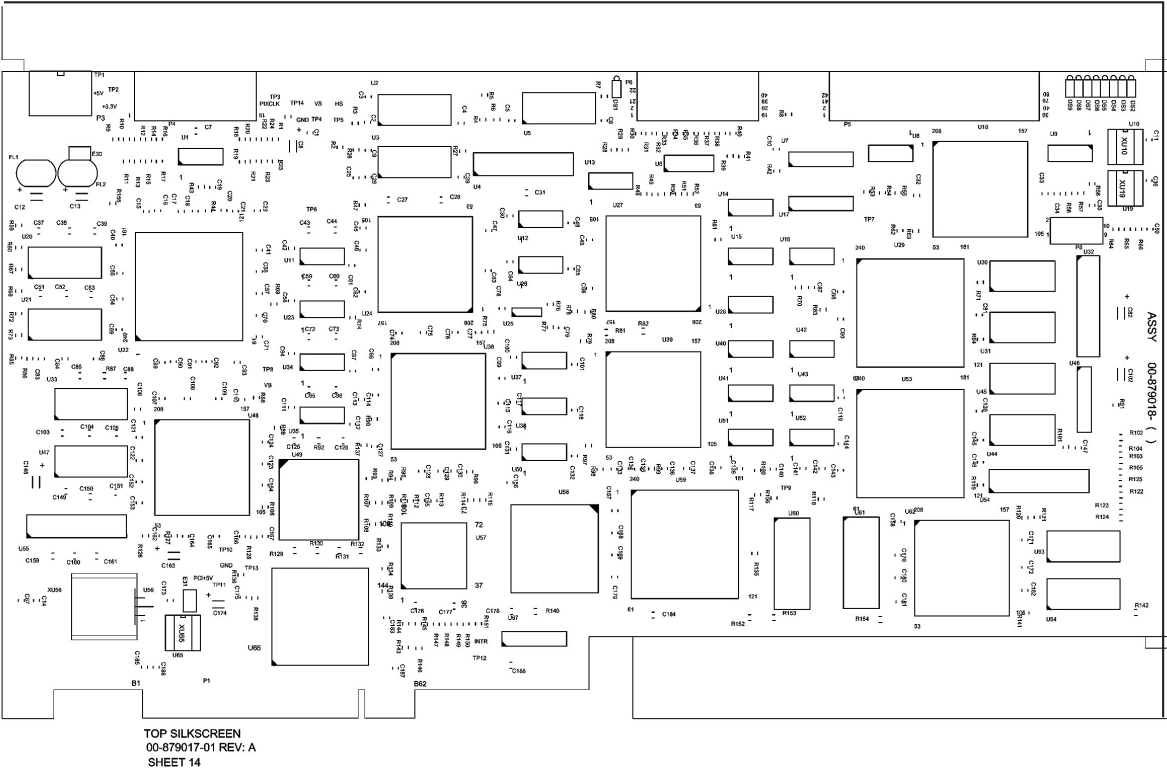


Image Processor PCB

Circuit Description

Please refer to **Image Processor Schematic 00-879016** while reading the following information.

Like the Video Controller, the Image Processor is a complex PCB with many surface mount components. The following paragraphs will help you understand the circuitry on a basic level so you can determine when the board has failed.

The Image Processor PCB has five connectors:

- P1** is the PCI connector. It connects PCI slot 6 on the Host Pentium motherboard or Passive Backplane. The board receives commands and reports data back to the Host Controller over this connection.
- P2** is not an assigned designator on the Image Processor PCB; this connector does not exist.
- P3** receives + 5 VDC power from the DC Distribution board. P3-1 is the +5 Volt sense line. Sense is measured on the **System Interface PCB**. P3-2 and P3-6 are +5 Volts, and P3-5 and P3-8 are ground.
- P4** receives digital video from the Video Controller PCB.
- P5** is the digital video output to the Display Adapter PCB.
- P6** is the digital video connector to the Cine Bridge PCB.
- P7** is not an assigned designator on the Image Processor PCB; this connector does not exist.
- P8** is the Altera Configuration Connector. It is not used.

Test Points

Although there are a few test points along the front edge of the Image Processor PCB, none are really useful in troubleshooting the board. There is no extender for the card, so test points not along the front edge of the card are not accessible.

Circuit Breakers and Fuses

There are no circuit breakers or fuses on the Image Processor PCB.

Troubleshooting

Symptoms that indicate possible Image Processor PCB failure include:

- Workstation lockup or failure - Look for power failure on P3.
- No response from PCI bus - Failure of the PCI9050 interface chip.
- System lockup - Missing or failure of Pixel Clock from the Video Controller PCB.
- No display - Missing or failure of Pixel Clock from the Video Controller PCB.

The Image Processor PCB has nine LEDs that can provide limited troubleshooting help.

Removal and Replacement

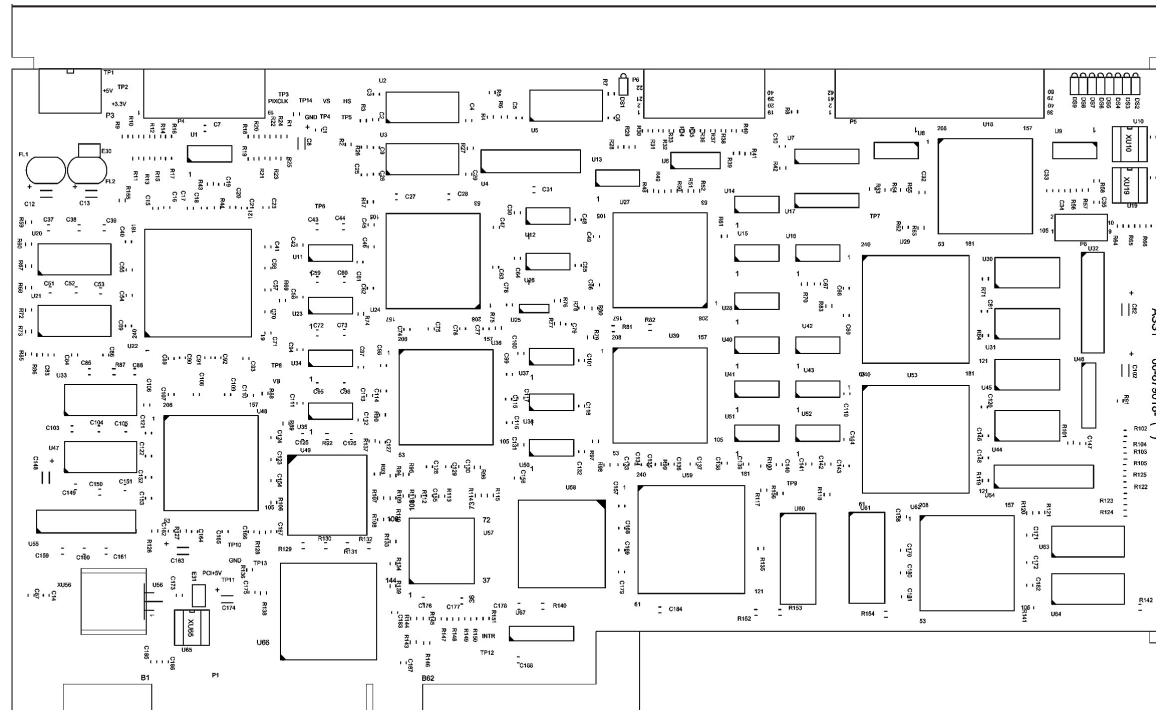
Follow these steps to replace the Image Processor PCB:

1. Turn off the Workstation and unplug it from the AC outlet.
2. Remove the Workstation Front Cover.
3. Open the Electronics box and locate the **Image Processor PCB**.
4. Remove the two screws that secure the PCB to the Electronics box.
5. Carefully remove all cables connected to the front edge of the PCB. If necessary, tag connectors for easier identification later.
6. Withdraw PCB from Electronics box and place in antistatic bag
7. Connect cables you removed in step 5 to replacement Image Processor PCB.
8. Install replacement Image Processor PCB in Electronics box.
9. Install screws you removed in step 4.
10. Connect Workstation to AC outlet and test it for proper operation.
11. Close Electronics box.
12. Install Workstation Front Cover.

Display Adapter PCB

The Display Adapter PCB translates the 25 or 30 FPS non-interlaced 1024 x 1024 images generated in the Image Processor to 75 Hz non-interlaced video for the high-resolution display monitors. The Display Adapter also converts the non-interlaced Image Processor video to interlaced video that is compatible with PAL or NTSC video cassette recorders. The board also has a printer interface that transmits digital images to the hardcopy (Lenzar) camera.

The Display Adapter PCB mounts in PCI slot 5 on the Host Pentium motherboard or the Passive Backplane. The following assembly drawing shows the major components on the board.



Display Adapter PCB

Circuit Description

Please refer to **High Resolution Display Adapter Schematic 00-881445** while reading the following information.

The Display Adapter is a complex PCB with a high percentage of surface mount components. It is not practical to service this board in the field. You should replace it if you believe it has failed.

The Display Adapter performs the following tasks:

- Accepts commands from and supplies data to the Host Controller.
- Latches in digital video from the Image Processor over P9.
- Buffers digital video for the left monitor, right monitor, and VCR.
- Performs digital-to-analog conversion of digital data for left monitor, right monitor, and VCR.
- Buffers analog video to left monitor, right monitor, and VCR.

Test Points

TP10 - Fast Scan Video to Left Monitor

TP15 - Fast Scan Video to Right Monitor

Circuit Breakers and Fuses

There are no circuit breakers or fuses on the Display Adapter PCB.

Troubleshooting

Symptoms that indicate possible Display Adapter PCB failure include:

- No video - Indicates possible failure of +5-Volt supply, ± 12 -Volt supply, or both
- VCR records poor picture or no picture - Failure of scan conversion circuits
- Hardcopy camera fails - printer port failure (P11)
- Display Adapter does not respond to PCI bus - PCI9050 chip failure
- System locks up - Missing or failure of pixel clock from input connector

The Display Adapter PCB has a few LEDs that are of limited troubleshooting value.

Removal and Replacement

Follow these steps to replace the Display Adapter PCB:

1. Turn off the Workstation and unplug it from the AC outlet.
2. Remove the Workstation Front Cover.
3. Open the Electronics box and locate the **Display Adapter PCB**.
4. Remove the two screws that secure the PCB to the Electronics box.
5. Carefully remove all cables connected to the front edge of the PCB. If necessary, tag connectors for easier identification later.
6. Withdraw PCB from Electronics box and place in antistatic bag.
7. Connect cables you removed in step 5 to replacement Display Adapter PCB.
8. Install replacement Display Adapter PCB in Electronics box.
9. Install screws you removed in step 4.
10. Connect Workstation to AC outlet and test it for proper operation.
11. Close Electronics box.
12. Install Workstation Front Cover.